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Range extension of *Mirinaba cadeadensis* (Morretes, 1952) (Gastropoda: Pulmonata: Strophocheilidae) along the coast of Paraná, southern Brazil

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ABSTRACT: *Mirinaba cadeadensis* (Morretes, 1952), a strophocheilid land snail, is known from Morro Cadeado, Estrada da Graciosa and Pico Marumbi, all located in the Atlantic Rainforest biome along the coast of Paraná state, Brazil. Based on material from the collection of the Museu de História Natural Capão da Imbuia (Curitiba, Brazil) and newly collected specimens, we report the occurrence of this species in 11 new localities in this region.

The Strophocheilidae Pilsbry, 1902, composed of the genera *Strophocheilus* Spix, 1872; *Mirinaba* Morretes, 1952; *Speironepion* Bequaert, 1948; *Austroborus* Parodiz, 1949; *Chiliborus* Pilsbry, 1926; *Gonyostomus* Beck, 1837 and *Anthinus* Albers, 1850, is exclusively from South America (Leme 1973). The genus *Mirinaba* Morretes, 1952, with 10 species, is restricted to the southeastern and southern Brazil (Simone 2006). In the last 40 years, a few works dealing with *Mirinaba* have been published (Leme 1973; Leme *et al*. 1979; Indrusiak 1985; Indrusiak and Leme 1985; Vieira and Simone 1990). Indrusiak and Leme (1985) conducted a comparative study of *M. antoninensis* (Morretes, 1952), *M. cadeadensis* (Morretes, 1952) and *M. curitybana* (Morretes, 1952), pointing out diagnostic shell and internal anatomy features.

The type locality of *Mirinaba cadeadensis* (Figure 1) is Morro Cadeado, Morretes municipality, coast of Paraná state, Brazil (Morretes 1952; 1953). This species is also known in the adjacent mountainous areas of Estrada da Graciosa and Pico Marumbi (360-700 m above sea level), which extend 13 km from north to south (Indrusiak and Leme 1985; Simone 2006). At all these locations, the dominant vegetation is classified as Ombrophilous Dense Forest (Atlantic Rainforest) (Roderjan *et al.* 2002). The climate is humid subtropical, without a dry season, and with heavy rainfall and high air humidity (Maack 1981).

The natural history of *Mirinaba cadeadensis* is still poorly understood. Indeed, it is a species difficult to find and observe due to its fossorial habits and preference for humid areas in forest (Morretes 1952; Indrusiak and Leme 1985). *Mirinaba cadeadensis* has a dark brown margin of the foot, sometimes almost olive, gradually changing to gray on the dorsal surface; its tentacles are light gray (Figure 1A) (Indrusiak and Leme 1985).

Indrusiak and Leme (1985) found some variation in peristome thickness and color of *Mirinaba cadeadensis* collected at Morro Cadeado and Estrada da Graciosa. The peristome, in both localities, varied from narrow and delicate to thick and its color varied from milky white to pale pink or deep red. The shell of the holotype (MZSP 18998), deposited in Museu de Zoologia da Universidade de São Paulo (São Paulo, Brazil), has a height of 59 mm and a width of 30 mm, as cited in literature (Morretes 1952; Indrusiak and Leme 1985; Simone 2006).

This study records 11 new occurrences of *Mirinaba cadeadensis* in the Serra do Mar, along the coast of Paraná state, expanding the known distribution. The material studied is composed of 30 empty shells and one live specimen, collected between 1946 and 2013, deposited at Museu de História Natural Capão da Imbuia (MHNCI), Curitiba, Paraná, Brazil: MHNCI 670, 1 shell, Santa Cruz, Serra da Prata, Paranaguá, A. Mayer col., VI.1946; MHNCI 671, 1 shell, Santa Cruz, Serra da Prata, Paranaguá, A. Mayer col., VI.1946; MHNCI 672, 1 shell, Santa Cruz, Serra da Prata, Paranaguá, A. Mayer col., VI.1946; MHNCI 673, 1 shell, Santa Cruz, Serra da Prata, Paranaguá, A. Mayer col., VII.1948; MHNCI 674, 1 shell, Serra da Prata, Paranaguá, A. Mayer col., VII.1948; MHNCI 812, 1 shell, Sítio do Meio, Matinhos, I.F. Zanardini col.; MHNCI 2706, 4 shells, Cubatão, Guaratuba, A. Mayer col., IX.1950; MHNCI 3869, 1 shell, Guaricana, Guaratuba, F.C. Straube col., IX.1985; MHNCI 5140, 1 shell, Marumbi, Morretes, 1963; MHNCI 5148, 3 shells, Trilha do Salto do Tigre, Serra da Prata, Matinhos, M.V. Gernet col., 12.XI.2006; MHNCI 5149, 4 shells, Morro Itaguá, Serra da Prata, Matinhos, (25°50'49" S, 48°32'48" W), M.V. Gernet col., 05.X.2008; MHNCI 5150, 1 shell, Morro Cabaraquara, Serra da Prata, Guaratuba, L.A. Fragoso col., 09.II.2012; MHNCI 5151, 1 shell, Morro Itaguá, Serra da Prata, Matinhos, (25°50'49" S, 48°32'48" W), C.J. Birckolz col., 13.III.2010; MHNCI 5152, 2 shells, Colônia Pereira, Serra da Prata, Paranaguá, (25°31'01" S, 48°35'45" W), L.F.D. Faraco & M. Miretzki col., 08.VIII.2012; MHNCI 5153, 1 shell, Trilha da Torre da Prata, Serra da Prata, Morretes, (25°36'06" S, 48°42'13" W), R.F. Torres col., 25.VIII.2012; MHNCI 5154, 1 shell, Colônia Quintilha, Serra da Prata, Paranaguá, (25°38'23" S, 48°38'25" W), L.F.D. Faraco col., 12.IX.2012; MHNCI 5157, 1 shell, Trilha da Figueira Gigante, Serra da Prata, Paranaguá (25°40'05"

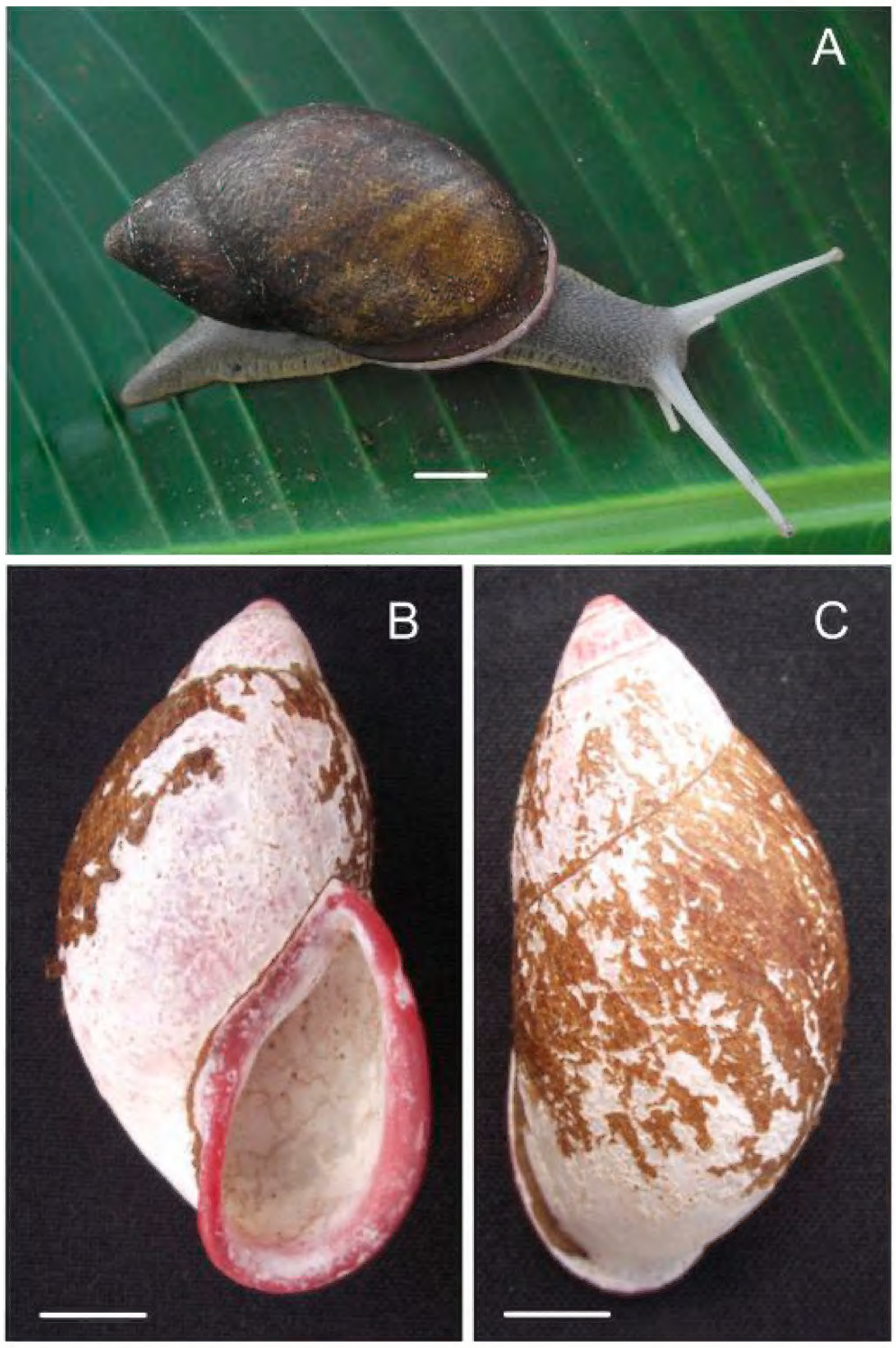

Figure 1. *Mirinaba cadeadensis* live animal (A), ventral (B) and dorsal (C) views of a shell. A: MHNCI 5187, B and C: MHNCI 5157. Scale bar = 10mm. Photos: MVG.

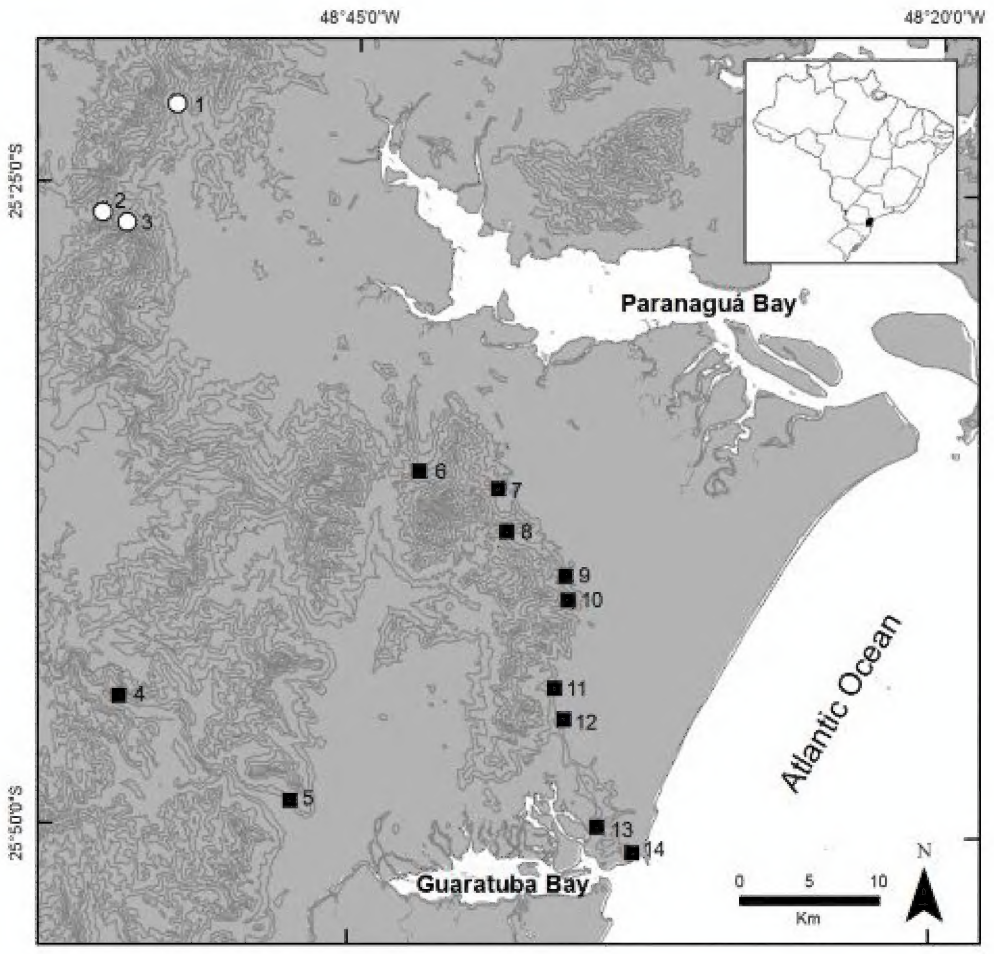

Figure 2. Localities of *Mirinaba cadeadensis* from coastal Paraná State. Open circles and solid squares indicate the known and new localities, respectively. Each line represents 100 metres in altitude. 1: Estrada da Graciosa, Morretes; 2: Morro Cadeado, Morretes (type locality); 3: Pico Marumbi, Morretes; 4: Guaricana, between São José dos Pinhais and Guaratuba; 5: Cubatão, Guaratuba; 6: Trilha da Torre da Prata, Morretes; 7: Santa Cruz, Paranaguá; 8: Quintilha, Paranaguá; 9: Trilha da Figueira Gigante, Paranaguá; 10: Colônia Pereira, Paranaguá; 11: Trilha do Salto do Tigre, Matinhos; 12: Sítio do Meio, Matinhos; 13: Morro Cabaraquara, Guaratuba; 14: Morro Itaguá, Matinhos.

S, 48°35'51" W), J. Quadros col., 14.IX.2012; MHNCI 5186, 4 shells, Morro Itaguá, Serra da Prata, Matinhos, (25°50'49" S, 48°32'48" W), M.V. Gernet & C.J. Birckolz col., 01.V.2013; MHNCI 5187, 1 specimen, Morro Itaguá, Serra da Prata, Matinhos, (25°50'49" S, 48°32'48" W), M.V. Gernet & C.J. Birckolz col., 01.V.2013. Permissions to collect were obtained from federal and state environmental organizations Instituto Chico Mendes de Conservação da Biodiversidade and Instituto Ambiental do Paraná (SISBIO/ICMBio nº 36442-1 and IAP nº 453/12).

Nine new localities in the region of Serra da Prata (municipalities of Morretes, Paranaguá, Matinhos and Guaratuba), Cubatão (municipality of Guaratuba) and Guaricana (covering Guaratuba and São José dos Pinhais municipalities) extend the known distribution of *Mirinaba cadeadensis* 46 km to the south from Pico Marumbi, the formerly southernmost known locality (Figure 2). The extension of the known distribution for this species is now 59 km from north to south and the known altitudinal range is 30-700 m a.s.l. At the Morro Itaguá site, the species was living at 30 m a.s.l. and only 400 m from the shoreline. This is the lowest altitude recorded for the species.

Among the shells studied, differences were observed in the peristome, as previously noted by Indrusiak and Leme (1985). The single specimen from Guaricana, for instance, has a thick, white peristome, while the shells from Serra da Prata (n=26) and from Cubatão (n=4) have peristomes varying from narrow to thick and from white to light pink or red.

The localities recorded here for *Mirinaba cadeadensis*, are natural protected areas (Pico do Marumbi State Park, Saint-Hilaire/Lange National Park, Serra do Mar and Guaratuba Environmental Protection Areas) and all neighboring areas are still preserved, however constantly threatened by construction projects of roads and railways. To help the conservational efforts of *M. cadeadensis*, a better knowledge of its taxonomy, morphological variation, distribution and ecology is required.

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